

REMARKS

Reconsideration of all grounds of rejection and allowance of all of the claims are respectfully requested. Claims 1, 4-6, 8, 9 and 12-19 are pending herein.

Base claims 1 and 15 have been amended to clarify that the current conversion circuit comprises at least two transistors having opposite channel polarities to provide both linear conversion and logarithmic conversion capability, wherein the two transistors comprise either a first P-channel transistor and at least a second N-channel transistor (claim 1) or a first N-channel transistor and at least a second P-channel transistor (claim 15), with the first transistor operating as an ideal switch. Support is shown in the drawing and original specification at page 3, line 33 to page 4, line 13, page 8, lines 5-14 and page 11, lines 19-26. Several of the dependent claims have been amended solely to improve form.

I. Objection to the Specification

The Abstract has been amended to overcome the objection thereto regarding the use of certain terminology.

II. Rejection of Claims under 35 U.S.C. §103(a)

Claims 1, 4-6, 8, 9 and 12-19 stand rejected under 35 U.S.C. §103(a) as allegedly being obvious over Hagihara (EP 1041818, hereinafter EP'818) in view of Merrill et al. (U.S. 6,731,397, herein after "Merrill"). This ground of rejection is traversed for the reasons indicated herein below.

III. Applicant's traversal of rejection under 35 U.S.C. §103(a)

It is respectfully submitted that none of the pending claims would have been obvious to a person of ordinary skill in the art in view of the combination of EP'818 and Merrill.

Claims 1 and 15 have been amended to clarify that the current conversion circuit comprises at least two transistors having opposite channel polarities to provide both linear conversion and logarithmic conversion capability, wherein said at least two transistors comprising a first P-channel transistor and at least a second N-channel transistor (claim 1), or vice versa (claim 15). The photo-sensitive reception means 11 has a polarity inverted from that shown in Fig. 1 if the first and transistor channel polarities are selected as recited in claim 15 (original specification, page 11, lines 19-26).

The Office Action asserts EP'818 discloses a photo-sensitive element in a circuit substantially the same as that in the present claims, except for the current conversion circuit of EP'818 failing to disclose that the two transistors are of different types, the first being a P-channel and the second being an N-channel (or vice versa, as disclosed in the embodiments shown in Figs. 1 and 2, and as claimed in base claims 1 and 15). However, it is further alleged Merrill discloses choosing conductivities of transistors requires only routine skill in the art, and the choice of two different types of channel polarities would make the circuit of EP'818 more efficient. It is respectfully submitted the combination of EP'818 and Merrill fails to disclose, suggest, or provide any motivation for the artisan to modify the circuit of EP'818 based on anything gleaned from Merrill, or the combination of EP'818 and Merrill.

For example, Merrill at column 6, lines 40-50, says nothing more than an active pixel sensor may be implemented with all N-channel transistors, with all P-channel transistors, or with a combination of N and P channel transistors. Merrill does not indicate, suggest or provide any motivation as to why a current conversion circuit with two transistors, as presently claimed, would require a first P-channel transistor and a second N-channel transistor to perform the desired function and to obtain the desired objects of the invention. Thus, the artisan cannot be

said to glean from the combination of EP'818 and Merrill that the present claimed invention is obvious.

In fact, it is respectfully submitted a person of skill in the art would not have found any incentive to combine the disclosures EP'818 and Merrill. Even presuming the artisan would have combined the teachings of the two disclosures, the combination, as a whole, would still not disclose, suggest or motivate the artisan to modify the two disclosures to arrive at the present invention. The claimed invention is not a matter of design choice, as alleged in the Office Action.

Applicants further submit the teachings of the combination of EP'818 and Merrill, teach away from the claimed invention. All of the embodiments disclosed in EP'818 show two transistors T1 and T3, which form the current conversion circuit, are always of the same type (either all N or P).

In fact, all the transistors in each of the entire embodiments, not just the current conversion circuits, are all of the same type of channel polarity. For example, Figures 32 to 44 of EP'818 all show P-channel type transistors. Thus, the person of ordinary skill in the art would understand that EP'818 teaches that the transistors forming one pixel must all be of the same type. Merrill, in combination with EP'818, fails to teach the structure of the claimed invention, or provide suggestion or motivation. (The position of the arrow, inward or outward, identifies the polarity of the channel of the transistors, as understood by the artisan).

In addition, Applicants also respectfully submit the combination of EP'818 and Merrill fails to render any of the present claims obvious because EP'818 discloses at column 37, paragraph 0139 that "Figs. 29 and 32 to 46 show seventeenth to thirty-second embodiments, which are examples of different versions of the first to sixteenth embodiments described above in

which MOS transistors of the opposite polarity are used. Accordingly, in Figs. 28-46, all of the elements used and the voltages applied have the opposite polarities”. However, nowhere is there any disclosure, incentive or motivation provided to make a circuit with one P-transistor and one N-transistor, or a combination of P-transistors and N-transistors.

In other words, EP’818 disclose a dual solution, one with all the transistors of a first polarity, and a second solution with all of the transistors having a second polarity, opposite the first polarity of the first solution.

On the other hand Merrill discloses at column 6, lines 40-50 that an active pixel sensor may be implemented with all N-channel transistors, with all P-channel transistors or with a combination of N and P channel transistors. However, Merrill fails to disclose, suggest, or provide motivation such that in combination with EP’818 an artisan would glean a current conversion circuit needs a first P-channel transistor and a second N-channel transistor. EP’818 and Merrill fail to disclose or suggest the two transistors form a current conversion circuit to perform the desired function and obtain the desired objects of the present claimed invention.

Thus, the combination of EP’818 and Merrill does not disclose or suggest the present claims.

Furthermore, the specification further supports Applicants’ assertion that the claimed invention is not “a simple matter of design choice.” The original specification at page 3, lines 4-11, states “[T]he purpose of the invention is to achieve a photo-sensitive element for electro-optical sensors, which is suitable to supply good quality images at high repetition frequency both when there is low light and also in the presence of an input signal characterized by high dynamics.” The next paragraph states “... the purpose of the invention is to obtain an output signal deriving, in conditions of low illumination, from the reading of the output of the signal

arriving from the photo sensitive element and, in conditions of high illumination, from reading the logarithmic conversion in tension of the current input signal.”

To elaborate, the invention in the first embodiment (Figure 1) as well as Claim 1 uses the P-channel transistor as an ideal switch. Thus it may assume a reset state if the external voltage (signal line 27, also please see page 9, lines 16 and 17 of the original specification) applied is low, and an integration state if the external voltage applied is high (page 4, lines 7-13 and page 9, lines 27-31 of the original specification (i.e. in the reset state of the first transistor).

The second transistor (22), which is of the N-channel in the first embodiment (Figure 1), is switched-off (which is like stating the transistor is essentially short-circuited by the P-channel transistor, as disclosed on page 4, lines 14-15 of the original description) when the voltage is low, i.e. in the reset state of the first transistor (21), whereas it causes a logarithmic compression of the photo-detected signal (as an active load) when the P-channel transistor is in the integration state, i.e. when the applied external voltage signal has a high value.

In the embodiment shown in Figure 1, the second transistor (22), having the function of a load, with the connections disclosed respectively to ground and to the photo-sensitive node (25), could not be a P-channel, otherwise its behavior would not be as a linear load for a correct functioning in the logarithmic zone (see original specification, page 10, lines 18-21).

On the other hand, the first transistor (21), which is of a P-type and has a reset function could not be an N-channel, otherwise, if a terminal were connected to the photodiode and the feed voltage, the pixel would never operate in a linear zone, unless the gate voltage was very low and therefore with a great loss of range of the whole photosensitive device.

In the dual embodiment shown in Figure 2, the polarities of the transistors are all inverted, but the connections to ground and the photosensitive node (25) are also inverted, to

allow the first transistor (210 and of the N-channel type) and to the second transistor (220 and of the P-channel type) still to perform the respective function of reset transistor and of active load.

Thus, for all of the foregoing reasons, the claimed invention, with two different channel polarity transistors obtains a better performance in the detection of the incident light signal than the combination of EP'818 and Merrill, both in low and high light environments, because the transistors adapt themselves, and their behavior to the external conditions.

Thus, Applicants respectfully submit that none of the present claims would have been obvious to a person of ordinary skill in the art at the time of invention in view of EP'818 and Merrill. Reconsideration and withdrawal of this ground of rejection are respectfully requested.

VI. Conclusion

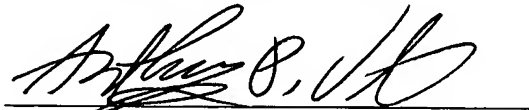
For all the foregoing reasons, all grounds of objection and rejection in the Office Action have been overcome. A Notice of Allowance is respectfully requested.

If there are any issues which may be best resolved by telephone, please contact the undersigned attorney at the local Washington, D.C. telephone number listed herein below.

Respectfully submitted,

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